Global experiences with subsidising economic insurance in agriculture

Part I

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Abstract

This two-part article is devoted to the key issues of subsidising economic insurance in agriculture, as viewed from a global perspective. The article draws on the work of researchers associated with the World Bank, Food and Agriculture Organization of the United Nations (FAO), International Food Policy Research Institute (JFRPI) and the Organization of Economic Cooperation and Development (OECD), as well as a review of subject literature conducted using a modified b a c k w a r d s n o w b a l l i n g technique combined with manual searches. This approach therefore follows the conventions of systematic review. In addition, the author applied their long-standing experiences concerning agricultural insurance and risk management to the selection and analysis of problems. The first part focuses on a review of justifications (premises) for subsidising agricultural insurance and its impact on the insurance market, as well as on decisions made in this area by agricultural producers. The basic purpose of this part is to provide generalised knowledge in order to better understand ongoing processes, functioning mechanisms and dependencies, and consequently to improve the efficiency and effectiveness of this form of public intervention. The conducted analysis produced three conclusions. Firstly, a wide-ranging set of arguments in favour of subsidising agricultural insurance is used worldwide. Such arguments refer to both economic theory and social and political circumstances of the intervention itself, which, by their nature, are difficult to verify empirically and evaluate in a professional manner. Secondly, subsidising the prices of insurance products under c e t e r i s p a r i b u s conditions leads to a quantitative development of the insurance market, although in the long run these prices should be based on solid actuarial foundations. Thirdly, using insurance subsidies means that farmers considering whether to purchase insurance cover are guided not just by the wish to reduce their risk exposure, but also the possibility to obtain additional transfers from the budget.

Keywords: insurance decisions of farmers, demand for insurance in agriculture, subsidising agricultural insurance, agricultural insurance.

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Research methodology

The structure of both parts of the article is based on the convention used by the Journal of Economic Literature (JEL), the first issue of which appeared in 1969. Today, it has a very high impact factor (IF) equal to 12.905, and has been assigned 200 points in the Polish list of scientific journals. JEL publishes review articles, which are usually double the length of the present text. The articles present the discussed issues from a historical perspective in order to show their evolution, but often also the relevance of earlier views. This evolutionary approach has also been applied in this study. Accordingly, the first part cites, among others, the work of P. Hazell, R. Sberro-Kessler and P. Varangis from 1986, because the views presented there are still current. In addition, as a true milestone in the understanding of mechanisms and consequences of subsiding insurance of crops and animals, this work continues to be referred to by many contemporary authors. The same convention has also been used, for example, with respect to a study of demand for agricultural insurance (the second part of the article). The article also takes into account the newest subject literature, including titles with a publication date of 2024, a rarity among Polish authors. Such a synthetic approach, on the one hand, implies an abbreviated approach to certain topics, but on the other encourages fellow researchers to develop and deepen them. The author himself intends to do so in subsequent articles on the topic.

The entire article refers to the rich output of renowned worldwide centres: the World Bank, FAO, International Policy Research Institute (IFPRI) and the OECD. The researchers employed therein tackle fundamental issues related to subsidising agricultural insurance, while using databases from many countries worldwide characterised by a very varied level of development and setting distinct objectives for their own agricultural policies. Their experiences are therefore of a universal nature. The analytical part of the entire article, on the other hand, presents a number of formal approaches, mainly those proposed by US agricultural economists. After all, it cannot be denied that in the United States insurance of crops has been subsidised for more than 80 years, and that the resulting experiences are all but invaluable. The article's author believes that the work of Chinese researchers likewise deserves careful study, since this country is currently the second largest market of economic insurance in agriculture, second only to the USA. The theoretical level and empirical instruments used by the Chinese are sometimes already more advanced than their

US counterparts[1]. In Poland, the topic of economic insurance in agriculture has also been dealt with by a number of researchers, however their predominant approach is descriptive[2]. This article therefore fills an existing gap in Poland, providing academic added value. The case of subsidising agricultural insurance in Poland will, however, only receive marginal attention, as a separate text on this is in the workings.

The entire article uses a combination of a modified backward snowballing method and manual (traditional) searches to peruse subject literature. The essence of backward snowballing is to designate a set of key tentative/start titles and then iterate backwards while adding new items[3]. The modification consisted of choosing twelve English language and two German language journals for the starting pool. The author of the article has been monitoring these journals constantly for twenty years and is well informed on the kind of publications found there. In addition, an assumption has been made that the articles must have an impact factor and the journals must be assigned at least 70 points in the Polish list of scientific journals. Coupled with thorough knowledge of the topic or research, this combination is at least as effective as a systematic review of literature found in digital databases[4]. Thanks to this approach, the analysis found below demonstrates a high degree of currency and also logically delves into all the most important problems in the area of subsidising agricultural insurance.

The basic objective of the first part of the article is a synthetic presentation of arguments used all over the world to support the need of subsidising agricultural insurance and its impact on the agricultural insurance market, as well as on decisions of farmers whether to purchase coverage against various risks. Thus generalised, the

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1. Z. Chai, X. Zhang, *The Impact of Agricultural Insurance on Planting Structure Adjustment – An Empirical Study from Inner Mongolia Autonomous Region, China*, "Agriculture" 2024, Vol. 14, No. 41.
2. A. Gorzelak, J. Kopańska-Herda, J. Kulawik et al., *Ocena funkcjonowania ubezpieczeń upraw i zwierząt gospodarskich w rolnictwie polskim*, Warsaw, IERiGŻ PIB, 2017; M. Janowicz-Lomott, K. Łyskawa, *Wspieranie ubezpieczeń rolnych przez państwo – doświadczenia polskie i wskazania unijne*, "Wiadomości Ubezpieczeniowe" 2009, nr 2; M. Janowicz-Lomott, K. Łyskawa, *Ubezpieczenia rolne* [in:] *Ubezpieczenia*, red. nauk. W. Ronka-Chmielowiec, Warsaw, Wydawnictwo C.H. Beck, 2016; M. Janowicz-Lomott, K. Łyskawa, *Uogólnienie dotychczasowych krajowych i zagranicznych doświadczeń z subsydiowaniem i regulacją sektora ubezpieczeń rolnych* [in:] *Analizy popytu i podaży na rynku ubezpieczeń rolnych*, red nauk. M. Soliwoda, Warsaw, IERiGŻ PIB, 2021.
3. C. Wohlin, *Guidelines for Snowballing in Systematic Literature Studies and Replication in Software Engineering*, Technical Report EBSE-2007–01, School of Computer Science and Mathematics, Keele University, 2007.
4. S. Jalali, C. Wohlin, *Systematic Literature Studies: Database Searches vs. Backward Snowballing*, Proceedings International Conference on Evaluation and Assessment in Software Engineering, 2014; C. Wohlin, M. Kalinowski, K. Romero Felizardo et al., *Successful combination of database search on snowballing for identification of primary studies in systematic literature studies*, "Information and Software Technology" 2022, Vol. 147.

knowledge should subsequently be used to improve the effectiveness and efficiency of this form of public intervention, and to develop its professional evaluation.

In the belief of the author, the entire article has the nature of original scientific work, as it generalises global experiences with using subsidies in agricultural insurance, and does so while showing the historical perspective of evolving views and empirical research on this issue. In addition, the discussion is solidly grounded in microeconomic theory and in insurance economics, as the author analyses insurance decisions, the functioning of the insurance market, and the demand for insurance products in conditions of subsidy. The author did not come across such an approach in the studied literature. Moreover, the article is of practical value, as it can be used to design, implement and evaluate public interventions of this kind. The work is addressed primarily to researchers and specialists in agricultural insurance, people well-versed in the foundations of neoclassical microeconomics and the "insurance economics" based on it. For this reason, such obvious notions as moral hazard, adverse selection (anti-selection) or actuarially accurate net premium do not need to be defined in the article.

Justification (premises) of subsidising

The most general justification for the intervention of governments in the insurance of crops is, on the one hand, the incompleteness and unreliability of markets, and on the other, the need to increase the resilience of the agricultural sector to withstand various shocks, especially those that jeopardise the income of farmers. As far as the markets are concerned, controversies do appear. Undoubtedly the spatial correlation of certain risks, which gives them a systematic character and sometimes makes them dependent on natural forces, may considerably hinder the development of the agricultural insurance market, although the existence of imperfections cannot be equated with the non-existence of such risks. It is often the case that farmers have other, internal instruments for mitigating risk and do not need to evince demand for insurance products. It can also happen that even if some imperfections appear, demand for insurance will remain low, even as imperfections are mitigated. This suggests that other obstacles, such as high transactional and administrative costs, still persist[5].

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5. G.F. Santeramo, F.A. Ramsey, *Crop Insurance in the EU: Lessons and Caution from the US*, "Eurochoices" 2017, Vol. 16, No. 3.

H. Chang and D. Zilbermann offer yet another justification for public support for agricultural insurance, even in well-functioning markets[6]. A reliably designed programme of agricultural insurance may cause fewer deformations than post-disaster assistance, which is greatly susceptible to the influence of agricultural groups of interest, as it contains a redistributive component and encourages rent seeking. Such programmes may also be flexibly combined with other public policies, for example from the environmental sphere. Access to subsidised agricultural insurance is not infrequently dependent on compliance with specific agrotechnical, zootechnical and environmental practices ("cross-compliance"). Mandatory insurance of farmers against disaster risk, so that they are able to obtain support related to liquidity or debt management, may be proposed as another solution. Combining instruments belonging to different government programmes into one package may increase demand for insurance, for example by reducing adverse selection.

P. Hazell, R. Sberro-Kessler and P. Varangis point to two wide groups of justifications for subsidising agricultural insurance:
1) correcting failures and externalities in agricultural insurance markets; externalities should be understood as shifting the consequences of risk-taking behaviour of the insured to their environment;
2) ability to achieve broader social and political goals[7].

In the first group, subsidies may be used to support investments characterised as public goods and consisting of building station infrastructure to measure weather parameters and other information necessary to design and offer insurance products. Equally importantly, such support from the budget may generate network consequences for the entire financial sector and disaster assistance programmes. As can be seen, the goal here are "non-regret" investments, which the OECD treats as an important factor in bolstering the resilience of agriculture within a holistic risk management system.

The second example in the first group of arguments justifying the granting of subsidies is a situation in which positive externalities appear. This occurs when cheaper insurance allows poor farmers to implement technology that improves their income and finances. In this case, the subsidies allow such farmers to become lower-risk borrowers from the point of view of credit institutions or suppliers of innovative technology. On the other hand, these institutions can act as risk aggregators.

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6. H. Chang, D. Zilbermann, *On the political economy of allocation of agricultural disaster relief payments: Application to Taiwan*, "European Review of Agricultural Economics" 2014, Vol. 41, No. 4.
7. P. Hazell, R. Sberro-Kessler, P. Varangis, *When And How Should Agricultural Insurance Be Subsidised? Issues And Good Practices,* Washington D.C., World Bank Group, 2019.

Temporary subsidies can also be justified when farmers or insurers are uncertain whether a new insurance product is met with sufficient interest. This is because we currently lack the necessary knowledge to assess its risk reduction potential, other benefits, and the entirety of generated costs. Such shortage of information about a new product is usually caused by difficulties in comparing it to already known products. An important role can be played here by suppliers of means of production who are able to provide them free of charge for a limited time in order to allow farmers to learn to appreciate them. When insurance is being introduced, insurers usually apply high overheads to net premiums because assessing their actuarially accurate level is problematic. Subsidies to premiums or reinsurance may help shorten the initial learning and experience acquisition phase for all market participants. It would be ideal, however, if the coverage offer became cheaper at some point.

Another argument for temporary subsidising of insurance is also the willingness to provide farmers with support in activities related to adapting to changing climate, a strategy aligned with the general area of bolstering the resilience of agriculture. Particular attention should be paid here to the situation of smaller farms, since they are likely to suffer the most as weather anomalies become more severe.

Yet another reason for sensible insurance subsidies is the possibility to transfer losses in agriculture to the entire rural non-farm economy. This mechanism can be easily understood via reference to demand limitations in agriculture that result in lower purchases of goods and services by agricultural manufacturers. In this case, as always, a decision to subsidise agricultural insurance should be preceded by considering whether similar effects cannot be achieved by ensuring adequate insurance coverage to non-farmers.

The last premise in the first group is the possibility of generating positive effects for consumers. The cause-and-effect chain supposed to operate behind the scenes is as follows: agricultural insurance subsidies → cheaper basic agricultural materials and food → more demand from consumers → higher sales of agricultural products. The key issue here is the price flexibility of demand for agricultural raw materials and food. The lower the flexibility, the higher the rates of subsidising agricultural insurance should be. Actually, it may occur that the social excess will nevertheless be smaller than the social cost of subsidy. The nature of supporting agricultural insurance makes it similar to reducing the costs of investment outlays in agriculture. In their case, it turns out that, when all is said and done, a net benefit appears only in combination with other external benefits.

Among broader social and political goals that governments try to achieve by subsidising agricultural insurance, P. Hazell, R. Sberro-Kessler and P. Varangis list the following:

1. Increasing agricultural production or food and agricultural exports. This applies mainly to developing countries. The war in Ukraine has also caused more attention to be directed towards issues of volume of agricultural production in rich countries. The same influences may be exerted by the European Green Deal that raises concerns among farmers in Europe.
2. Improving equity of access to the insurance market on a more permanent basis by offering a more privileged position to smaller farms.
3. Increasing the incomes of small agricultural producers by using subsidised rates that make claim payments received by farmers higher than the premiums they pay. Such a policy is equal to treating insurance subsidies as an additional income transfer.
4. Making insurance subsidies the main component of the financial safety net in agriculture, and thereby compensating agricultural producers for disaster-related losses.
5. Gathering funds for disaster assistance programmes in order to make access to disaster payments quick and assured. This can occur by setting suitably high premium rates that generate more inflows than lump sum payments when disasters occur.
6. Protecting banks crediting farmers and special credit programmes against accumulated bad debt, mostly as a consequence of systemic risk that materialises in the agricultural sector.

In their World Bank study on 65 countries worldwide, including Poland, O. Mahul and J.Ch. Stutley propose five general rationales for the involvement of public authorities in public insurance[8]. These are:

1. M a r k e t   a n d   r e g u l a t o r y   i m p e r f e c t i o n s. Speaking in detail, the following kinds of imperfections are distinguished: (1) informational asymmetries and their widely known consequences in the form of adverse selection (anti-selection) and moral hazard; (2) systemic risk that causes disaster risk to materialise, which puts forward the issue of reinsuring agricultural insurance, with the possibility of governments becoming last ditch reinsurers, and post-disaster assistance for affected farmers; (3) lack of suitable technical and information infrastructure to design, distribute and enforce insurance contracts, and produce and implement innovation; (4) low risk awareness (risk blindness) and the lack of a widely understood insurance culture among farmers and rural dwellers, often as a result of poverty and destitution; (5) a legal and regulatory environment that is not adapted to impartial

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8. O. Mahul, J.Ch. Stutley, *Government Support. Challenges and the Options for Developing Countries*, Washington, D.C., The World Bank, 2010.

and quick resolution of disputes in traditional insurance, and which does not more widely promote index contracts and other forms of insurance covering losses that go beyond simple impairment of physical assets (for example the loss of profits).

2. Pricing and subsidising agricultural insurance. The basic challenge here is protecting the costs of coverage against various risks transferred from agricultural farms to insurers. In this context, a key role is played by an entire string of activities that consist of calculating and setting insurance rates and premiums. The process begins with reflecting the frequency and size of losses in agricultural farms themselves, followed by a phase in which insurers gross up the pure risk premium by adding various overheads, and finally an attempt to assess overheads related to the possibility that systemic and disaster risk manifests. In practice, amid all these activities, governments can utilise a broad set of intervention instruments. On the other hand, in the case of subsidies, emphasis should be placed on connecting them as accurately as possible to individual risk exposures of farmers, which helps to enlarge the area of efficient operation of insurance and financial markets. In other words, the goal is to leverage government support to supply public goods. Practice shows that this is very difficult, as politicians very often treat subsidies as an opportunity to set up and maintain patron and client relationships, and moreover subsidies edge out other risk management instruments. Such relationships should be understood as situations in which, in return for the benefits obtained (friendly regulations or subsidies), the beneficiaries "return the favours" to patrons (politicians) at various kinds of elections. Such relations are asymmetrical, bilateral and usually persistent. In the longer term, they limit the freedom and autonomy of beneficiaries and reduce social welfare[9]. A separate issue, however, is the compatibility of the national or EU system of agricultural insurance subsidies with WTO regulations.

3. Compulsory versus voluntary insurance. Reference to compulsory insurance can be the result of various causes: (1) the desire to avoid or reduce ad hoc disaster assistance; (2) making farmers aware of the existence of systemic risk; (3) the drive to eliminate adverse selection; (4) supporting a mechanism of risk splitting, and pooling and reducing the fixed operational costs of the insurance sector. A specific form of compulsory insurance is the requirement that coverage must be purchased by farmers who take out credits and loans. Not all these justifications are convincing (a case in point is the single risk pooling mechanism). The most controversial aspect of such insurance, however, is the fact that low-risk farmers are forced to cross-subsidy producers with high risk exposure. It should

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9. A. Heywood, *Politologia*, Warsaw, Wydawnictwo Naukowe PWN, 2010.

not therefore be surprising that the former group often treats the insurance obligation as a form of tax. This topic is very broad, complex and controversial, and goes beyond the scope of this article.

4. C l i m a t e   c h a n g e. Nowadays, listing this justification seems natural, but more than ten years ago it was a courageous decision to make. Given the context, such a decision seemed thoroughly logical, as O. Mahul and J.Ch. Stutley devoted considerable space to disaster risk (primarily drought) in their analysis. In doing so, they presented various methods of dealing with this risk, mostly through index insurance.

5. M o d e r n i s i n g   t h e   a g r i c u l t u r a l   s e c t o r. The primary activities that need to be listed here are easier access to credit thanks to insurance, encouraging farmers to undertake activities with more favourable risk-profit ratios, and rationalisation of pre- and post-disaster assistance. The latter problem should be understood in many ways. Firstly, insurance can serve to reduce such assistance. Secondly, insurance instruments used to assess risk may also be helpful in planning post-disaster assistance. Thirdly, the assistance itself can be insured or even reinsured and secured via alternative risk transfer instruments.

So far, complex studies concerning the parallel impact of agricultural insurance and crops on (primarily) the situation of agricultural producers, food consumers and taxpayers, carried out following the conventions of economic welfare analysis, are strongly felt to be lacking. In this context, a 2012 article of V.H. Smith and J.W. Glauber should be treated as very important and still relevant[10]. The essence of their discussion is shown in Figure 1. In default of government intervention on the crop insurance market, the demand curve for this service would be represented by D_0 and its supply by private insurance companies by S_0. For the latter the minimum price, that is the premium rate, is P_{min}. Unfortunately, this price is not acceptable to farmers, due to how the *choke price*, P_c, evolves. The choke price is a price at which the demand for a good/service equals zero. Only when the price falls below P_c may some demand emerge. This shows that in the above conditions a private crop insurance market cannot appear. This situation will only begin to change with government subsidies targeted at farmers and/or insurance companies. If, for example, the subsidised part of the premium was E_1F, a new demand curve, D_1, would appear, and the acreage of covered crops would equal A_0. Of course, the market itself would achieve equilibrium in point E_1, but with the price of P_i the farmers could now at least pay the lower price of P_f. At the same time, taxpayer costs arise, whose amount is represented

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10. H.V. Smith, W.J. Glauber, *Agricultural Insurance in Developed Countries: Where Have We Been and Where Are We Going?*, "Applied Economic Perspectives and Policy" 2012, Vol. 34, No. 3.

by the rectangle $P_i E_1 FP_f$, which is the sum of areas *a*, *b* and *c*. Area *c* is the so-called consumer surplus obtained by farmers, derived from their increased income and greater stability. The insurance industry, on the other hand, obtains producer surplus (triangle *a*). Finally, the trapezoidal area *b* is the so-called minimum deadweight cost of financing the insurance subsidy program with taxes. A complete analysis should, of course, also take into account all external benefits and costs generated by these subsidies. Unfortunately, no relevant studies following so broad a convention have as of yet been conducted anywhere in the world. The work of P. Hazell, C. Pomaveda and A. Valdés, which is commented upon below, may, however, serve as an interesting introduction to this approach[11].

Figure 1. Welfare effects on crops insurance subsidies
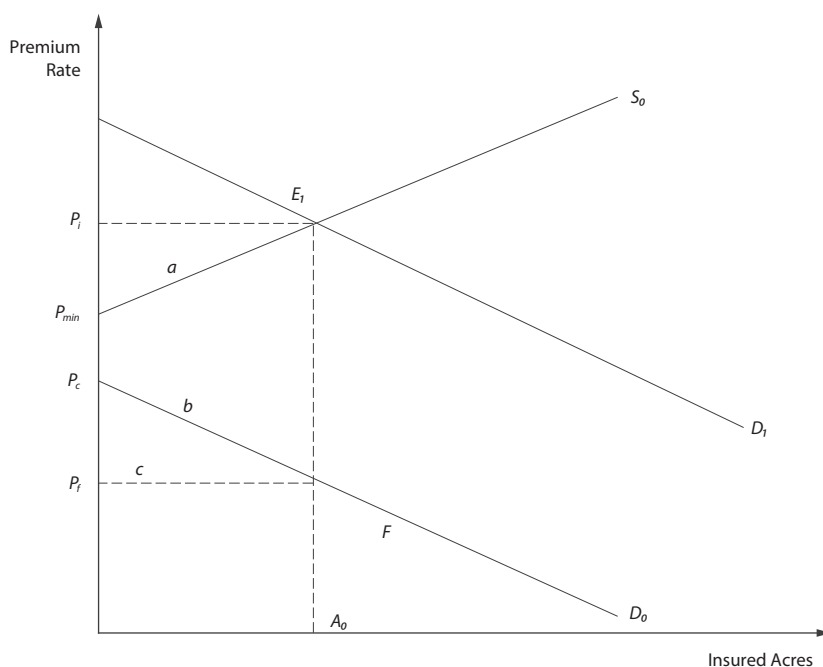
Source: Own study based on H.V. Smith, W.J. Glauber, Agricultural Insurance in Developed Countries: Where Have We Been and Where Are We Going?, "Applied Economic Perspectives and Policy" 2012, Vol. 34, No. 3.

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11. *Crop Insurance for Agricultural Development Issues and Experience*, ed. P. Hazell, C. Pomaveda, A. Valdés, Baltimore and London, The Johns Hopkins University Press, 1986.

Subsidies and the agricultural insurance market

Each reduction of costs that insurance companies bear when operating the agricultural insurance market could decrease the prices of products, specifically insurance premium rates, prompting a surge in demand. This problem is explained in Figure 2. Here again the market is at equilibrium in point E_1 and the acreage of insured crops (as in Figure 1 above) is equal to A_0. The coverage price for farmers (P_f) is likewise unchanged. Unfortunately, the costs of insurance companies rose, causing the efficient supply curve S_0, provided at minimum marginal cost, to shift to the inefficient delivery supply curve S_1. The market equilibrium is now found in point E_2, which means an increase of the premium subsidy rate, and therefore also the final price of insurance. The implications for welfare are clear: the taxpayer cost is additionally increased by the rectangular area $P_{i1} E_2 E_1 P_i$. Lost welfare also grows by the same amount. Once again, a complete analysis should take into account the costs of lobbying of insurance companies, sustained while rent seeking and related to obtaining additional subsidies. Such costs, as US studies show, may sometimes be considerable[12]. Another important thing here is that the object of the model also includes commission pocketed by agents and brokers who offer insurance to the farmers themselves.

In the context of the situation on the Polish market of subsidised agricultural insurance, so-called package (multi-risk) insurance, two conclusions from the above analysis appear relevant:

Insurance rates paid by farmers should not rise if demand is not to be choked. Such rises jeopardise the predefined insurance coverage level as one of the objectives of the programme.

Total insurance rates, including costs sustained by insurance companies, should be verified by licensed actuaries. Commission paid to insurance agents and brokers should also be reviewed. The purpose here is to achieve the objective of the second programme, that is minimise its costs for taxpayers, to a satisfactory extent. Insurance programmes should, after all, be based on their actuarial value, that is the equality of premiums and expected losses in short-term tendencies and over the long term.

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12. K.B. Goodwin, *Problems with Market Insurance in Agriculture*, "American Journal of Agricultural Economics" 2001, Vol. 83, No. 3; V. Smith, J. Glauber, R. Dismukes, *Rent Dispersion in the US Agricultural Insurance Industry*, IFPRI Discussion Paper 01532, May 2016; J. Pearcy, H.V. Smith, *The tangled web of agricultural insurance: evaluating the impacts of government policy*, "Journal of Agricultural and Resource Economics" 2015, Vol. 40, No. 1.

Figure 2. Welfare impacts of excessive delivery costs
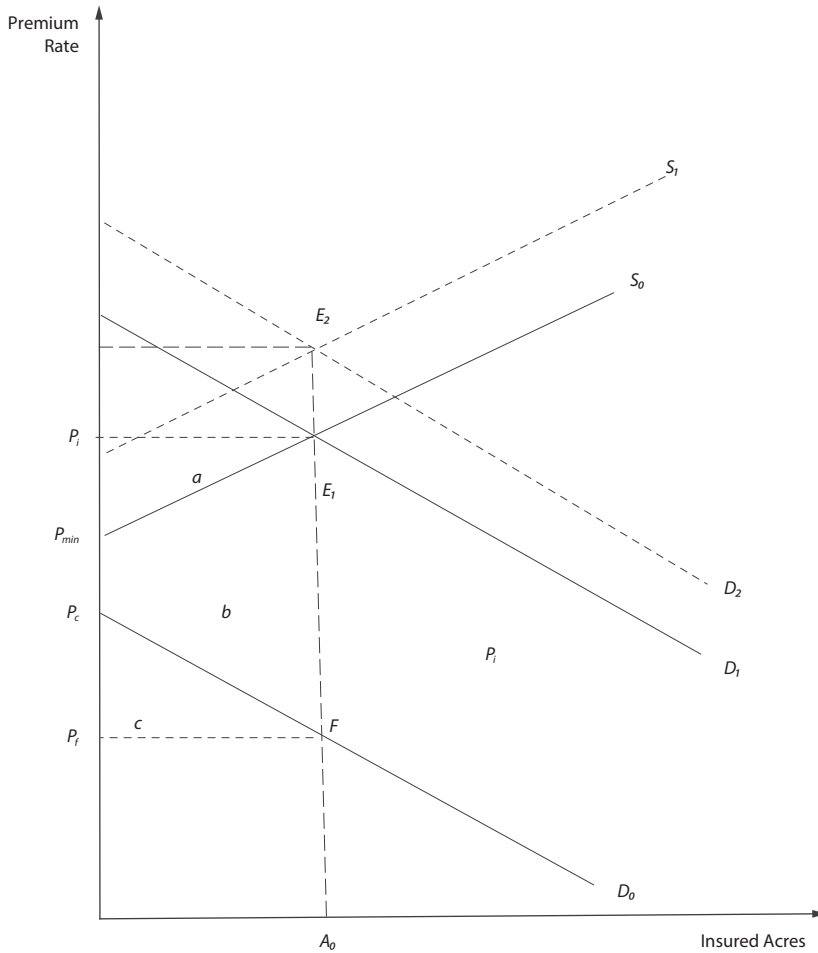
Source: Own study based on H.V. Smith, W.J. Glauber, Agricultural Insurance in Developed Countries: Where Have We Been and Where Are We Going?, "Applied Economic Perspectives and Policy" 2012, Vol. 34, No. 3.

Finally, it is worth discussing in more detail the views of P. Hazell, R. Sberro-Kessler and P. Varangis found in their 1986 book. Let's start with analysing Figure 3. The figure depicts the simple relationship between the agricultural product price and its quantity. Insurance, on the other hand, appears as an institutional innovation. If farmers purchase insurance on commercial terms, the original demand curve S_0, representing lack of insurance coverage, shifts to curve S_1.

Figure 3. Welfare gains to consumers and producers from insurance
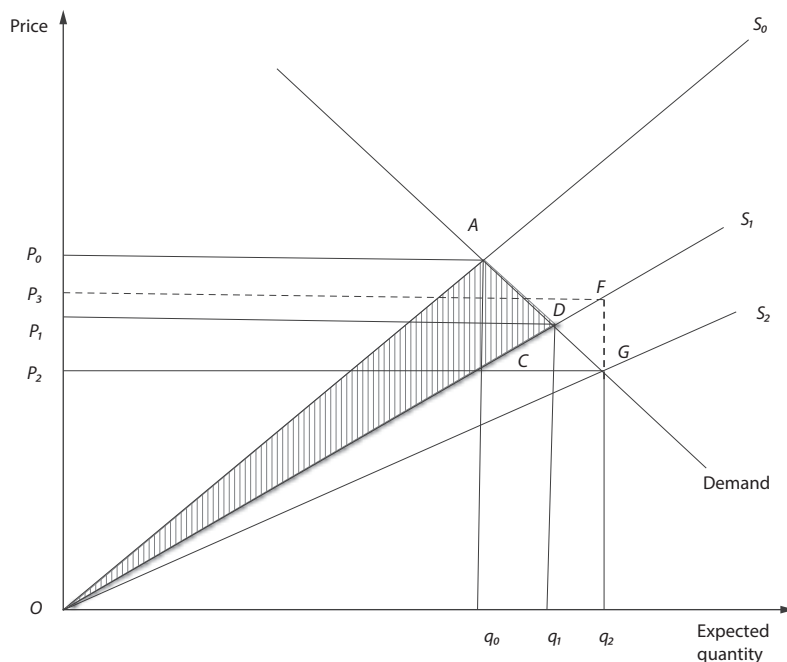
Source: Own study based on Crop Insurance for Agricultural Development Issues and Experience, ed. P. Hazell, C. Pomareda, A. Valdés, Baltimore and London, The Johns Hopkins University Press, 1986.

If demand for a good is not perfectly elastic, there will be a fall in price from P_0 to P_1. On the other hand, the quantity supplied will increase from q_0 to q_1. In effect, consumers will gain a surplus represented by the rectangle P_0ADP_1, which can be treated as an external benefit. Some, however, view it as compensation for farmers, for example by subsidising premiums. At this point, P. Hazell, C. Pomared and A. Valdés immediately add that if demand is perfectly elastic, farmers will capture all the surplus and the case for a subsidy disappears. Against the latter argument, the trio of researchers offers yet another line of thought. A farmer who purchases commercial insurance reduces their costs, which also include the expenditure for coverage, by AC, and the net savings are represented by the triangle DAC. However, since there is a drop in prices of agricultural products, their net welfare will be P_1DO less P_0AO. This difference may be either positive or negative for the sector as a whole or individual agricultural products. On the other hand, consumer gain is represented by the triangle P_0ADP_1. The net change of total social welfare is the shaded triangle

OAD, the size of which depends on the magnitude of the shift of supply from S_0 to S_1 and the price flexibility on the side of both supply and demand.

If the current government, motivated by reasons of redistribution and the conviction that farmers insure too few crops and livestock, decides to subsidise insurance, an adjustment process will take place to bring the market into equilibrium again. As a result, the new supply curve will shift to S_2. The price will therefore fall to P_2, but the amount of production will be q_2. The consumer and producer surpluses are represented by the triangle *ODG*, and they are always less than the subsidy cost (P_2P_3FG). Therefore, no matter what subsidy scheme is used (subsidising farmer premiums and/or support for insurers), there will always be a net social loss.

While P. Hazell, C. Pomareda and A. Valdés on one hand treat introducing insurance to agriculture as an institutional innovation, on the other they do not consider it as a kind of public good. This means that although the state is not particularly responsible for providing such insurance, neither may it ignore its importance. By way of analogy to product innovations, the trio of economists suggests that supporting research and implementation concerning economic insurance in agriculture from the budget would probably generate more positive social effects than simply supporting farmers and/or insurance companies. In their opinion, the world is largely steeped in deep ignorance as far as solid actuarial foundations of agricultural insurance are concerned. Only if we treat them as activities reducing the asymmetry of information, in an indirect, non-intuitive way, do prerequisites for public intervention appear. Such intervention, however, would probably be temporary (sunset clause) and offer limited amounts of subsidies.

P. Hazell, C. Pomareda and A. Valdés also consider two other social arguments that could be taken into account in potential subsidising of social insurance:

1) severe losses and a drastic decrease in living standards of small farmers who would be unable to afford commercial policies;
2) the appearance of so-called network externalities, or a transfer, as part of multiplication mechanisms, of decreased fund resources due to manifestation of widespread (systemic) risk to the entire local economies.

They immediately add, however, that public authorities should examine all other available options before they decide to implement subsidised insurance. With such a complex analysis of costs and benefits, it may even turn out that, all things considered, granting a d h o c assistance may sometimes be the best variant.

Another take of the authors on the demand for agricultural insurance and supply of that financial service, shown in Figure 4, is also very interesting. If only risk-neutral producers existed on the market, no equilibrium of any sort could form there. The situation may only change when insurance coverage is sought by risk-averse farmers. With the insurance price on the level of P_1, the quantity they buy may reach Q_1.

However, in order to make risk-neutral farmers interested in purchasing insurance, its price should not exceed P_0. Without the government subsidy, whose rate should be equal to the distance from P_1 to P_0, there is no chance of that happening.

Figure 4. Demand and supply curves for insurance
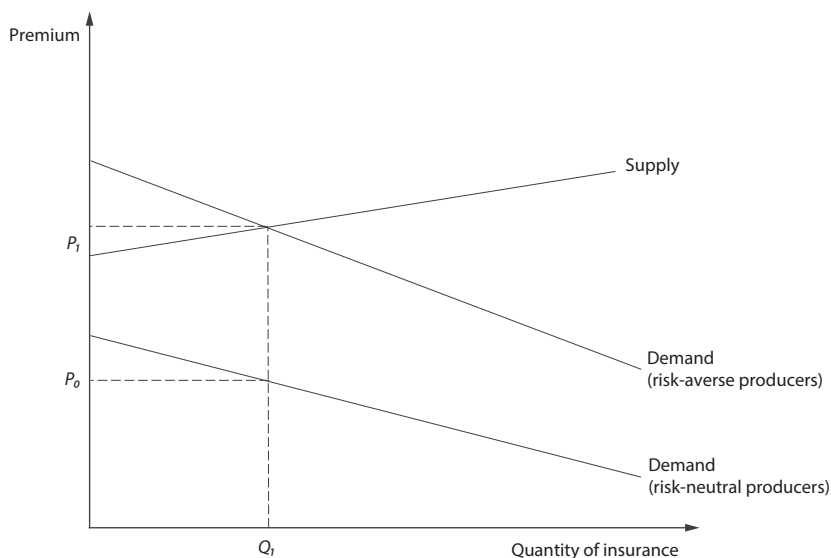
Source: Own study based on Crop Insurance for Agricultural Development Issues and Experience, ed. P. Hazell, C. Pomareda, A. Valdés, Baltimore and London, The Johns Hopkins University Press, 1986.

Insurance decisions of farmers in conditions of subsidy

In the absence of subsidies, the participants of a private, competitive insurance market should not derive extra profits from contracts they enter into if effective equilibrium conditions prevail[13]. This would also be compliant with the principle that insurance should not be a means of enrichment for the insured. Introducing subsidies, however, causes changes in risk exposure and generates uncertainty. This results in problems with actuarial optimisation of insurance contracts, which combined with the asymmetry of information and its consequences (adverse selection/anti-selection and moral hazard)

13. C.G. Walters, C.R. Shumway, H.H. Chouinard et al., *Asymmetric Information and Profit Taking in Crop Insurance*, "Applied Economic Perspectives and Policy" 2014, Vol. 37, No. 1.

could result in deviations from the required actuarial neutrality of insurance, which means that by behaving opportunistically, farmers whose decisions are driven by maximising profits achieve subsidies in excess of their original motivational part. This could, however, lead to increased burdens of taxpayers, with resource allocation in agriculture itself becoming ineffective. In these conditions, a charge can also be levied that the designers and administrators of insurance programmes are incompetent. It should be added that the very fact of subsidising insurance may encourage farmers to engage in opportunistic behaviour. For example, anti-selection mechanisms may diminish the importance of risk aversion as an insurance motive compared to the desire of obtaining support or taking advantage of insurance premiums that are lower than suggested by risk.

The asymmetry of information and its consequences in agriculture generates its own unique problem. In this sector, the boundary between participating in an insurance programme and a change in behaviour once a relevant contract has been entered into is not clearly delimited. This is because insurance and production decisions are usually made at the same time, and such circumstances make empirical identification and measurement of anti-selection and moral hazard difficult. The large spread of relevant empirical research results should therefore come as no surprise[14]. This is, at least partly, motivated by the fact that opportunism may also be the consequence of components of insurance contracts. This can be combined with the often-encountered paucity and problematic credibility of data on historical crop-related risks in agricultural farms.

Let us analyse in more detail the mechanism of opportunistic behaviour, which are an example of strategic use of asymmetry of information in insurance decisions of farmers. To this end, the formal approach of C.G. Walters, C.R. Shumway, H.H. Chouinard and R.P. Wandschneider will be used. We assume that farmers are risk-averse and want to maximise their own utility. Firstly, we should write down the farmer's utility function:

$$U = E(\pi) - f[V(\pi)],$$

where: U – utility; $E(\pi)$ – expected profit; $f[V(\pi)]$ – profit variance function. In default of insurance, profit per acre will be equal to:

$$\pi = py - wx,$$

where: p – prices of products; y – production/yield; w – expenditure price vector; x – expenditure per acre vector[15].

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14. M. Janowicz-Lomott, M. Kaczała, K. Łyskawa, *Rozpoznanie zakresu asymetrii informacji i jej następstw na rynku ubezpieczeń rolnych* [in:] *Analiza popytu i podaży na rynku ubezpieczeń rolnych*, red. nauk. M. Soliwoda, Warsaw, IERiGŻ PIB, 2022.

15. Ibidem.

Unfortunately, the very formula used to calculate profit contains its inherent variability.

Next, we should introduce into the analysis insurance purchased by the farmer that thereby becomes the lower boundary of profit. The insurance is described by the following formula: $I(y, y^*, z) - u(z,s)$, where: $I(\cdot)$ – claim payment; y^* – guaranteed yield; z – type of insurance contract; s – subsidy rate and $u(z,s)$ – premium paid by the farmer. Of course, if the actual yield is larger than the guaranteed yield, the farmer will not receive any compensation. The profit equation itself can now be written as follows:

$$\pi = py - wx + I(y,y^*,z) - u(z,s).$$

Opportunism may appear when the insurance premium $u(z,s)$ is not precisely linked to the expected claim payment. If there are no insurance subsidies, the system can be made neutral – one contract gives as much expected utility as another. In the case of subsidies, however, the manner in which they are used may cause deviations from neutrality. This means that an actuarially neutral insurance must preserve the following equality:

total premium = expected claim payment,

where the premium is the sum of the premium paid by the farmer and the government subsidy less refunded services of insurers. On the other hand, claim payment is the entire payment made by insurers on behalf of farmers. The premium paid by farmers is determined using the following formula:

farmer premium = total premium × (1 – subsidy),

where the subsidy should be understood as a value between 0 and 1. Thus we can write down the first method of expressing the neutrality of insurance as:

expected claim payment × (1 – subsidy) – farmer premium = 0

The other method modifies the first as follows:

expected claim payment (claim payment – subsidy – farmer premium) = 0

Both variants were used by C.G. Walters, C.R. Shumway, H.H. Chouinard and R.P. Wandschneider in empirical models as dependent variables. In general, we may conclude that if the rate calculation is actuarially accurate and the subsidies granted in accordance with adopted regulations, neutrality should be preserved and farmers should not achieve extra profits from insurance. It is enough, however, that one of these conditions are not met for such profits to appear. This will prove that opportunism does exist among farmers.

In the empirical section of their work, the authors conducted a number of regressive calculations and tests based on insurance data for crops such as corn, soybean and wheat in five different US regions in the period 1996–2009. The total number of observations was 392,035. At this point, we will limit ourselves to presenting the three most general conclusions:

1. Reducing opportunism among farmers who buy insurance would improve the cost effectiveness of this risk management instrument, bringing it closer to the ideal of actuarial neutrality. This expectation is of more importance for crop insurance compared to income insurance. In three of four discussed contracts, evidence of deriving extra profits from insurance was found. The incentive to do so was provided by a varied quality of usable agricultural land.

2. Subsidised insurance may therefore generate a certain ineffective allocation of resources, which is manifested in such extra profits. In this context, it is worth analysing insurance statistics to sift out contracts with particularly frequent payable claims. Later, increasing insurance rates and premiums for such contracts could be considered.

3. The not-so-large total range of deviation of actual results from the principle of actuarial neutrality of insurance contracts suggests that they were designed reliably. This might undermine the often-advanced conclusion that activities of public agencies in the area of agricultural insurance are ineffective. In the opinion of these authors, such allegations are often motivated by ideology and not grounded in solid scientific evidence.

A newer approach to this question will be presented in the second part of the article.

Summary

Governments explain the subsidising of agricultural insurance, first and foremost crop insurance, in various ways. The standard set of arguments refers to the incompleteness and unreliability of insurance markets, as well as to externalities and public goods, and specifically to the existence of information asymmetry that generates adverse selection and moral hazard. The arguments also rely on increased riskiness of agricultural income caused mainly by climate change, liberalisation of agricultural policies, globalisation and financialisation. Another premise used in standard arguments is that even disaster assistance can be replaced with subsidised insurance. If access to subsidies is properly conditioned, the environmental sustainability of agricultural production can also be improved in this way. Another broad group of justifications for agricultural subsidies is the possibility of using them to achieve multiple social and economic

objectives. The essence of such objectives is sometimes very extensive and also includes improving social justice and setting up a social security network for farmers and other rural dwellers. This is a very convenient foundation for extending and perpetuating this kind of support, even when it was originally meant as temporary (s u n s e t   c l a u s e).

The agricultural insurance market in conditions of subsidy is usually modelled using tools for partial equilibrium. These tools allow us to show the impact of various prices of insurance products on initiating transactions and quantitative changes of supply and demand. This, in turn, allows the construction of simple models showing changes in the welfare of farmers (consumer surplus), insurers (producer surplus) and the state, and also to identify situations in which subsidies cause social welfare to diminish. Now, however, we are in need of more advanced tools, such as general equilibrium or complex systems dynamics.

A farmer's decision to purchase insurance should be based on its actuarial neutrality, which implies not using it to achieve extra profits (for example in the form of additional income transfers). The appearance of insurance subsidies changes the risk exposure of farmers and is also a source of political risk for participants of the insurance market, as well as the origin of political rents reflected in rent seeking. Such subsidies also hinder the actuarial optimisation of insurance contracts, prompting, among others, opportunistic behaviour of farmers. In consequence, the reduction of production risk in agriculture via insurance could, for example, cause a simultaneous increase in environmental/ecological risk if farmers neglect good agrotechnical and zootechnical practices.

Bibliography

Chai Z., Zhang X., *The Impact of Agricultural Insurance on Planting Structure Adjustment – An Empirical Study from the Inner Mongolia Autonomous Region, China*, "Agriculture" 2024, Vol. 14, No. 41.

Chang H., Zilbermann D., *On the political economy of allocation of agricultural disaster relief payments: Application to Taiwan*, "European Review of Agricultural Economics" 2014, Vol. 41, No. 4.

Goodwin K.B., *Problems with Market Insurance in Agriculture*, "American Journal of Agricultural Economics" 2001, Vol. 83, No. 3.

Gorzelak A., Kopańska-Herda J., Kulawik J. et al., *Ocena funkcjonowania ubezpieczeń upraw i zwierząt gospodarskich w rolnictwie polskim*, Warsaw, IERiGŻ PIB, 2017.

Hazell P., Pomareda C., Valdés A., *Crop Insurance for Agricultural Development Issues and Experience*, Baltimore and London, The Johns Hopkins University Press, 1986.

Hazell P., Sberro-Kessler R., Varangis P., *When And How Should Agricultural Insurance Be Subsidized? Issues And Good Practices,* Washington D.C., World Bank Group, 2019.

Heywood A., *Politologia*, Warsaw, Wydawnictwo Naukowe PWN, 2010.

Jalali S., Wohlin C., *Systematic Literature Studies: Database Searches vs. Backward Snowballing*, Proceedings International Conference on Evaluation and Assessment in Software Engineering, 2014.

Janowicz-Lomott M., Kaczała M., Łyskawa K., *Rozpoznanie zakresu asymetrii informacji i jej następstw na rynku ubezpieczeń rolnych* [in:] *Analiza popytu i podaży na rynku ubezpieczeń rolnych*, red. nauk. M. Soliwoda, Warsaw, IERiGŻ PIB, 2022.

Janowicz-Lomott M., Łyskawa K., *Wspieranie ubezpieczeń rolnych przez państwo – doświadczenia polskie i wskazania unijne*, "Wiadomości Ubezpieczeniowe" 2009, nr 2.

Janowicz-Lomott M., Łyskawa K., *Ubezpieczenia rolne* [in:] *Ubezpieczenia*, red. nauk. W. Ronka-Chmielowiec, Warsaw, Wydawnictwo C.H. Beck, 2016.

Janowicz-Lomott M., Łyskawa K., *Uogólnienie dotychczasowych krajowych i zagranicznych doświadczeń z subsydiowaniem i regulacją sektora ubezpieczeń rolnych* [in:] *Analizy popytu i podaży na rynku ubezpieczeń rolnych*, red. nauk. Michał Soliwoda, Warsaw, IERiGŻ PIB, 2021.

Mahul O., Stutley J.Ch., *Government Support. Challenges and the Options for Developing Countries*, Washington, D.C., The World Bank, 2010.

Pearcy J., Smith H.V., *The tangled web of agricultural insurance: evaluating the impacts of government policy*, "Journal of Agricultural and Resource Economics" 2015, Vol. 40, No. 1.

Santeramo G.F., Ramsey F.A., *Crop Insurance in the EU: Lessons and Caution from the US*, "Eurochoices" 2017, Vol. 16, No. 3.

Smith V., Glauber J., Dismukes R., *Rent Dispersion in the US Agricultural Insurance Industry*, IFPRI Discussion Paper 01532, May 2016.

Walters C.G., Shumway C.R., Chouinard H.H. et al., *Asymmetric Information and Profit Taking in Crop Insurance*, "Applied Economic Perspectives and Policy" 2014, Vol. 37, No. 1.

Wohlin C., *Guidelines for Snowballing in Systematic Literature Studies and Replication in Software Engineering*, Technical Report EBSE-2007–01, School of Computer Science and Mathematics, Keele University, 2007.

Wohlin C., Kalinowski M., Romero Felizardo K. et al., *Successful combination of database search on snowballing for identification of primary studies in systematic literature studies*, "Information and Software Technology" 2022, Vol. 147.